

Ocean Temperatures Activity Key

*** For ease of use during class, the teacher key pages are numbered the same as the student book pages***

I. Introduction

Air temperature and sea surface temperature (SST) vary from season to season and with latitude. A location at 60° N latitude (Alaska) is much colder than one at 17° N latitude (Hawaii). The lower the latitude, the higher the temperature. Around the equator (latitude = 0) is the warmest latitude. Temperatures in areas that are near the water tend to be warmer than areas far away from water. The sea water helps to keep the land temperatures nearby warmer. During the year, air and SST warm and cool gradually. They are hottest in the summer and the coldest in the winter. This is, of course, for the northern hemisphere. In the southern hemisphere it is cold in June and warm in December.

Get Info Objectives

1. Explain what causes seasons.
2. List data collected by marine buoys.
3. Describe how data is transmitted worldwide.
4. Explain the difference between near-shore and offshore air and water temperatures.

Interpret Data Objectives

1. Collect information about marine buoy sites.
2. Record latitude and longitude of sites.
3. List times of most recent observations.
4. Read tables of current data and record information.
5. Interpret graphs of air and sea surface temperatures (SST).
6. Calculate the differences in temperatures of locations at different latitudes.
7. Collect data over the period of one week at a site closest to school and create a graph of the data.

Application Objectives

1. Predict air temperature changes based on past and current data.
2. Predict SST temperature changes based on past and current data.
3. Correlate air and SST to the effects of El Nino nationwide and locally.

- From the main screen, click "Get Info."

II. Get Info

A. What Causes Seasons?

- Click on the National Data Buoy Center site.
- Click on "NDBC" (National Data Buoy Center) under the flags.
- Click on the blue dot next to "Science Education".
- Click on "What causes our seasons"?

1. Read the information and respond in the space provided below. Did you know that our four seasons exist because of the tilt of the earth on its axis and because of the earth's orbit around the sun? The manner in which these factors produce our seasons is very easy to explain. Take a few moments to think about how this might occur and write your answer.

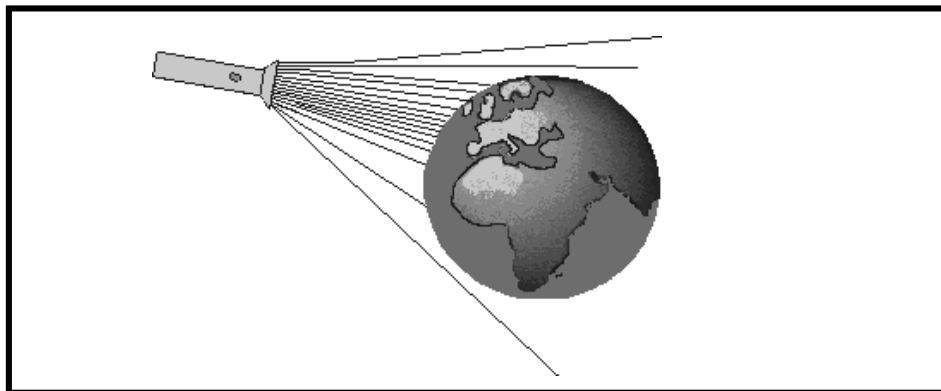
The sun's rays are more directly overhead in summer in the

northern hemisphere. In the winter, rays are slanted

making it cooler.

- After you have answered the question above, click Answer and check what you wrote.

2. Draw a diagram of the flashlight then explain how the angle of light from the flashlight is related to the sun's light on earth in different seasons.



When a flashlight shines directly on an object from

overhead, the light and heat are more concentrated. This

is similar to the sun's rays in summer. They heat the earth

more.




- Click "Back" until you get back to the NDBC Science Education page.

B. Air Temperature




- Click on "Are air temperatures the same over land and water?"
- Read the information and answer the following question.


- 
1. What do you think causes the difference in air temperatures between two stations that are only 192 miles apart?

The heat in the water is radiating into the air making it

warmer than the station near the land.

- 
- After you have answered the question click on Answer and check what you wrote.
 - Click "Back" until you get back to the NDBC Science Education page.

C. Water Temperature

- 
- Click on "Does water temperature differ between near-shore and offshore sites? Why or why not?"
 - Read the information and answer the following questions.

- 
1. Is the colder surface water close to shore or far from shore?

The colder water is closer to shore.

2. We know that water temperatures from near-shore sites differ from temperatures offshore. How does this occur?

~~—River runoff, continental air masses' effects on water~~

~~—temperature, near-shore ocean currents and upwelling~~

~~—effects affect the near shore sea surface temperature.~~

~~—Winds blow the warm surface water away from the shore,~~

~~—then water upwells to replace the warm surface water.~~



- After you have answered the question click on Answer and check what you wrote. Add anything you didn't think of.
- Click "Back" until you get back to the NDBC Science Education page.
- Click on "FAQ" (Frequently Asked Questions) on the blue bar at the bottom of the screen.

D. Buoy Sensors



- Click "Do NDBC's meteorological and oceanic sensors measure data for the entire hour?"

1. How long is data collected at the buoys?

12 minutes at moored buoys, 8 minutes at C-man buoys.



- Click "Back" to get back to the main FAQ site.
- Scroll to "At what heights are the sensors located on the moored buoys?"

2. How high are the air temperature sensors located on the buoy at station 41004?

4 meters



- Click on "What about the moored buoy hulls?"

3. How many different kinds of moored buoys are there? 9



4. Sizes range from 1.5 meters to 12 meters.



5. List the data moored buoys collect.

Barometric pressure, wind direction, wind speed, wind

gusts, air temperature, sea temperature, wave height,

dominant wave period, average wave period, wave

direction.



- Click "Back" until you get back to the main FAQ site.

E. Data Transmission



- Click on "How do measured data get from the buoy or C-MAN site to the various users worldwide?"



1. How are the data transmitted? Buoys transmit information to

of NOAA's Geostationary operational Environmental

Satellites (GOES) which transmit it to collection centers.

2. How often are data transmitted? hourly



- Click "Back" four times or until you get back to the Interactive Marine Observations site that shows the world map.

III. Gather Data

Alaska



- Click on the box that covers Alaska.
- Enter "46035" in the text box next to the "GO!" box.
- Click the "GO!" box.





A. Current Data for Alaska

1. What is the latitude? 56° 54' 38"N longitude? 177° 48' 38"W
2. Time of last observation? within an hour of the current time.
3. Current Meteorological Data
Temperature answers will vary daily

Sea level pressure answers will vary daily

Wind and Sea State Data
Sustained wind answers will vary daily

Gust answers will vary daily

Sea Surface Temperature answers will vary daily

Detailed Wave Data
Significant Wave height answers will vary daily

Average Wave period answers will vary daily



B. Recent Observations for Alaska

- Scroll down to "Data Older than 24 Hours."
 - Click "Real-time Data."
 - Click on "description" to the right of "Real Time Standard Meteorological Data."
1. What does "ATMP" mean? air temperature
 2. What does "WTMP" mean? water temperature
- Click "Back" to get back to the "46035 Real Time Data" site.





- Click on "Real Time Standard Meteorological Data".

Times in the chart are given in 24-hour format like military time. If the hour (hh) is given as 1 through 12, the times are a.m. and 12 o'clock is noon. If the hour is given as 13 through 23, subtract 12 from the time. You now have regular time p.m. If the hour is given as 00, it is midnight.



3. Record the air temperature and sea surface temperature (SST) for the last two days at 1am and 1pm (or close to it).

NOTE: all answers to questions 3, 4, 5, & 6 will vary daily.

Date _____	Air temp	SST
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1 am	_____	_____
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1 pm	_____	_____
------	-------	-------

Date _____	Air temp	SST
------------	----------	-----

1 am	_____	_____
------	-------	-------

1 pm	_____	_____
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4. What was the highest water temperature? _____

5. What was the lowest water temperature? _____

6. What is the difference between the lowest and highest water temperatures? _____

- Click "Back" until you get back to the site with the world map.
- Click on the left box on the Gulf Coast (not Florida).





Mobile, Alabama

- Enter "42040" in the text box next to the "GO!" box.
- Click the "GO!" box.

C. Current Data for Mobile

NOTE: all answers to questions 1, 2, & 3 will vary daily.

1. What is the latitude? _____ longitude? _____

2. Time of last observation? _____

3. Current Meteorological Data

Temperature _____

Sea level pressure _____

Wind and Sea State Data

Sustained wind _____

Gust _____

Sea Surface Temperature _____

Detailed Wave Data

Significant Wave height _____

Average Wave period _____



D. Recent Observations for Mobile

- Scroll down to the "Data Older than 24 Hours" section.
- Click "Real-time Data."
- Click "Real time standard meteorological data."

NOTE: all answers to questions 1, 2, 3, & 4 will vary daily.

1. Record the air temperature and SST for the last two days at 1am and 1pm (or close to it).

Date _____	Air temp	SST
1 am	_____	_____
1 pm	_____	_____

Date _____	Air temp	SST
1 am	_____	_____
1 pm	_____	_____

2. What was the highest water temperature? _____
3. What was the lowest water temperature? _____
4. What is the difference between highest and lowest temperatures?

E. Differences in Latitude

1. How many degrees latitude apart are Alaska and the Gulf Coast?

Bering Sea buoy 56° 54' 38" latitude

Mobile buoy 29° 11' 42" latitude (When you borrow, you
borrow 60 seconds)

27° 42' 56" difference

2. How is temperature affected by latitude?

As latitude increases, temperature decreases.

- Click "Back" until you get back to the OAR Ocean Temperature main site.

IV. Application

A. In Your Neighborhood - Or Close By

Pick a coastal area near where you live or one you have visited. Record the air and SST temperatures for a week (or longer). Record your data in a chart like the one below.

Day	Date	Time of Observations	Air Temperature	SST
Monday	3/23/98	9:00 a.m.	45	54
Tuesday	3/24/98	9:00 a.m.	47	55
Wednesday	3/25/98	9:00 a.m.	56	55

Graph your data on a graph like the one below. Fill in the temperatures on the y (vertical) axis. Write the days on the x axis

Temperatures

A blank grid of 10 columns and 20 rows. The grid is composed of thin black lines. A thicker vertical line runs down the left side of the grid, separating it from the text on the left.

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A T W T F A T W T F A T W T F
O U E H R O U E H R O U E H R
N E D U I N E D U I N E D U I

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- Buoy data is used to predict times of the year when maintenance

structures. Storm intensity can be gauged using buoy data. Buoys

coastal areas.



2. Who else might benefit from knowing the information collected by these buoys?

People who live on the coast can use buoy data to predict the
weather. Surfers, fishers, and people of vacation use the data to
know when the weather will be nice. Climatologists use it to model
weather patterns over the oceans and in coastal areas.

3. Based on data you collected about the site near where you live or have visited, what do you think the air temperature will be for;

answers to number 3 will vary.

the rest of the week? _____

the rest of the month? _____

three months from now? _____

4. If you have completed the El Nino site - What effect has El Nino had on the water and air temperatures in North America?

~~Water temperatures in the western Pacific have decreased.~~ _____

~~The air temperatures have increased in the winter.~~ _____

5. What effect has El Nino had on the area where you live?

~~Rainfall increases have been reported in the South and in~~ _____

~~the Western states. Winter temperatures have been~~ _____


~~unseasonably mild.~~ _____

6. Based on what you have learned about moored buoys in the ocean, design a buoy to collect data in outer space. Give it a name, list the measurements it will collect, and draw a diagram of it.

answers will vary.

V. Enrichment

A. Research

- 
1. Find out what the highest and lowest air and SST are for the area where you live.
 2. Interview local weather people. Find out where they get the information they use to forecast the weather.
 3. Find out what marine animals live in cold water and which ones live in warm water. Divide your list into mammals, fish, invertebrates. List the location and temperature range for each organism.
 4. Investigate the Inuit people (Eskimos) and how they live in cold weather and how they depend on the sea to live. Research their food, shelter, and clothing and how each relates to the sea.

5. Investigate Polynesians and how they live in warm weather and depend on the sea to live. Research their food, shelter, and clothing and how each relates to the sea.

B. Data Collection

1. If you live near the coast, keep a record of the air and water temperatures for a period of time. You can get this information from your newspaper or from the sites you visited in this activity. Graph the data you collect using a line or bar graph.
2. Collect news articles or search the web for information on El Nino and how it has affected air and water temperatures. Write a short report explaining what you found out.
3. Interview someone who fishes commercially. Ask what species are caught in warm water and what species are caught when it is cold. Make a chart listing what is caught when. Also indicate the amounts that are caught, if possible.

C. Related Web Sites

1. Interactive Marine Observations - Tides, Maps, Weather and wave conditions...
<http://www.nws.fsu.edu/buoy>
2. Wind and Wave Models
<http://polar.wmb.noaa.gov/regional.waves/Welcome.html#egc.wave.t00>
3. Buoy Locations, Information and Recent Data
<http://www.nodc.noaa.gov/BUOY/buoy.html>
4. Graphs of monthly averages of data collected from buoys
<http://www.ndbc.noaa.gov/climate.phtml>
5. National Data Buoy Center Home Page
<http://www.ndbc.noaa.gov/index.html>